Appendix B-4

Electrical Safe Facility Design, Reliability, and Maintainability Checklist

Purpose: This checklist identifies conditions which, when assured by design, enhance facility reliability and maintainability, and provide a work environment which limits the exposure of workers to electrical hazards which can result in device failure, fire, as well as injury or death. It's use is appropriate for new construction, demolition, or renovation of existing buildings. It checklist identifies the most common omissions and discrepancies in facility designs.

Topics addressed include life safety, considerations for the location of electrical equipment, design technologies which reduce the risk of electrocution and arc flash or fires, training, interior electrical systems and ground fault protection, transformers, insulated power circuits, emergency electrical systems, working space about electrical equipment, caution and warning signs, arc-fault hazard analyses, equipment marking, overcurrent protective devices, electric motors, switchgear, overhead power lines and cables, and underground distribution systems.

Requirement: Occupational Safety and Health Administration (OSHA) 29CFR Occupational Safety and Health Administration (OSHA) *29 CFR 1910 Subpart S;* National Fire Protection Association (NFPA) 70, the National Electric Code (NEC); NFPA 70E Electrical Safety in the Workplace; International Electrical Testing Association (NETA),*Acceptance Testing Standard (ATS);* International Electrical Testing Association (NETA), *Maintenance Testing Standard (MTS);*UFC 3-501-01, Electrical Engineering, July 1, 2012; UFC 3-560-01, Electrical Safety O&M, May 1, 2012; DA Pam 385-26: The Army Electrical Safety Program; Department of the Air Force, Headquarters Air Force Civil Engineer Support Agency, Engineering Technical Letter (ETL) 01-1: Reliability and Maintainability (R&M) Design Checklist, October 11, 2001;

Applicability: This checklist is a tool to aid the planner, designer, and maintainer to focus on materials, methods, and system components to improve O&M throughout the life cycle of DoD Facilities. It is appropriate for use by DoD Agencies, the Services, and DoD contractors.

DOCUMENT CHANGE TABLE			
DATE	AUTHOR	CHANGES MADE	VERSION

FACILITY CHECKLIST

Electrical Safe Facility Design, Reliability, and Maintainability Checklist

Number	Item	Y/N/NA
General Provisions For New or Renovation of Buildings, Installation of Electrical Systems		
Before commissioning a new building electrical system, or renovation of a building or electrical system check the following design items related to construction:		
1	Check legal building code and electrical code requirements for buildings, switchgear rooms, transformer rooms, elevator machine rooms, electrical closets, telecommunications rooms, etc.	
2	Electrical metering for buildings, as required.	
3	Are electric distribution design specifications available?	
4	Are UL listed or equivalent water proof fixtures provided in rooms containing moisture (e.g., dishwashing rooms)?	
5	Electrical superintendent has reviewed drawings and his comments considered?	
6	Has sensitive electronic equipment been installed in accordance with Federal Information Processing Standard (FIPS) Publication 195, *Federal Building Grounding and Bonding Requirements for Telecommunications*	
7	In critical operations power systems, does the risk assessment identify hazards, the likelihood of their occurrence, and the vulnerability of the electrical system to those hazards? *Refer to NEC 708, Critical Operations Power Systems (COPS).*	
8	Has a risk assessment been done which developed a strategy for providing physical security for critical operations power systems?	
9	Are the O&M Manuals a requirement in the project plans and specifications?	
10	Have the O&M Manuals been turned over to O&M?	
11	Has the Electrical Superintendent or other appropriate O&M Personnel reviewed the design drawings?	
12	Arc Flash Reduction Modes Switches (ARMS) shall be used on all equipment where possible. The associated OCPD shall be tested in accordance with the settings based on the engineering coordination and arc flash studies.	
13	Arc flash hazard analysis with incident energy calculations shall be completed.	
14	Load flow study is completed showing direction and amount of power flowing to each load shall be completed.	
15	Short circuit and coordination study is completed and one-line diagrams are available.	

Number	Item	Y/N/NA
16	Requirements for essential electric system distribution follow National Electric Code (NEC) wiring and protection, wiring methods and materials, and equipment requirements.	
17	Coordinate drawings with other technical disciplines.	
	Means of Egress	
18	Dual means of egress from transformer vaults, switchgear rooms, switchboard (over 1200 amps) rooms and generator rooms or buildings.	
19	Provide doors that open under simple pressure leading from the switchgear rooms, electrical rooms, transformer vaults, generator rooms and elevator machine rooms. The doors shall swing in the direction of exit travel.	
	Location of Electric Equipment	
20	Stack electrical closets and telecommunications rooms vertically.	
21	Show quantity of electrical closets on a floor: Maximum distance of the farthest branch circuit to the nearest closet shall not exceed 75 ft.	
22	All closets shall be free of columns inside.	
23	All electrical rooms, transformer vaults and closets shall not be located directly below showers, laboratories, kitchens, dish washing areas, roof drain leaders, cooling towers or other areas where water service is provided. Pipe containing liquids or gases shall not pass through these rooms.	
24	All wiring shall be installed in raceways.	
25	All underground raceways shall be encased in concrete.	
	Design Technologies/Features Which Reduce the Risk of Electrocution, Shock, Arc Flash or Fires	
26	High resistance grounding with associated control system to monitor phase to ground faults.	
27	Covered or isolated bus design for circuits.	
28	Current limiting fuses and current limiting breakers shall be used.	
29	Touch-proof equipment shall be used where needed.	
30	Remote operation of equipment must be used.	
31	"Smart" motor control centers shall be used where required.	
32	Arc-resistant enclosures shall be used.	
33	Fully extractable motor control center design.	
34	Ground-fault circuit interrupters shall be used.	
35	Arc fault interrupter circuit breakers shall be used.	
36	Motor controls are located away from the motor control terminal box or motor control center	
37	Use of "smart" motor control centers?	
38	Arc resistance motor control center?	

Number	Item	Y/N/NA
39	Inspection infra-red (IR) viewports shall be installed on all equipment requiring IR scanning.	
40	Arc resistant medium voltage or low voltage enclosures used?	
	Training	
41	Has all affected been trained in the correct operation of the equipment or systems?	
42	Is training a requirement in the project plans and specifications?	
	Interior Electrical Systems, Ground Fault Protection	
43	Is surge lightning and transient protection installed on service entrances, solid-state uninterruptible power supplies, and isolation transformers?	
44	Is there ground-fault protection on equipment for all 480V circuits above 1000 amps on a solidly grounded wye system?	
Note	*National Electrical Code [NEC] requires ground fault protection on grounded Wye services of 150 volts or more to ground, and 1000 amperes or more. Ground-fault protection of equipment (GFPE) is defined in Article 100 as "a system intended to provide protection of equipment from damaging line-to-ground-fault currents by operating to cause a disconnecting means to open all ungrounded conductors of the faulted circuit. This protection is provided at current levels less than those required to protect conductors from damage through the operation of a supply circuit over current protection device." Section 230.95 requires solidly grounded Wye electrical services with main disconnecting means rated at 1,000A or more to be provided with GFPE where the voltage is more than 150V to ground but does not exceed 600V phase-to-phase. The setting of the GFPE must not be greater than 1,200A and the maximum time delay before operation shall not exceed one second (60 cycles) for ground-fault currents of 3,000A or greater. In determining the setting for the ground-fault protection system, it is necessary to determine the permissible amount of damage to the electrical system. The higher the Ampere setting of the ground-fault device or the longer the ground fault is permitted to continue, the more damage to the system. Source: http://www.ecmag.com/section/systems/ground-fault-protection-systems-services*	
45	Ground Fault Protection for Equipment (GFPE) installed on service entrance feeders?	
46	GFPE installed on all feeder circuits to ensure electrical coordination?	
Note	*Where ground-fault circuit-interrupter protection for personnel is provided, the voltage shall be permitted to be greater than 30 but not more than 80 volts. Exception: In circumstances where are all conditions of NEC 427.74 are met; output voltage shall be not greater than 132 volts ac to ground.*	
47	*Has the maximum phase-to-phase fault current that is available at the main disconnect for the service been determined?*	
Note	*Either check with the local utility company for their fault values or figure an approximate value in accordance with engineering calculations.*	

Number	Item	Y/N/NA
Note	*"This standard, by adoption of ANSI/TIA/EIA-607- 1994, Commercial Building Grounding and Bonding Requirements for Telecommunications, specifies the requirements for a uniform telecommunications grounding and bonding infrastructure for Federal buildings where telecommunications equipment is installed" (Reference Federal Register, August 15, 1995, NIST, "Approval of Federal Information Processing Standards Publication 195, Federal Building Grounding and Bonding Requirements for Telecommunications." FIPS Publication 195 is available at: http://www.itl.nist.gov/fipspubs/fip195.htm*	
Note	*NEC-2011 Article 250 covers bonding and grounding.*	
48	Grounding systems in compliance with NEC? (No separate grounds for computers are permitted.)	
Transformers		
49	Isolation transformers grounded in accordance with NEC for separately derived sources?	
50	Is isolation transformer with a grounded shield between the primary and secondary windings used to isolate the distribution system from the heating system? (Refer to NEC-2011 426.31)	
51	Does the secondary winding of the isolation transformer connected to the impedance heating elements not have an output voltage greater than 30 volts ac, unless protected by a ground fault circuit interrupter protection for personnel? (Refer to NEC-2011, 426.32)	
Note	*An isolation transformer is a transformer of the multiple winding type, with the primary and secondary windings physically separated, which inductively couples its secondary winding(s) to circuit conductors connected to its primary winding(s). [Refer to NEC 517.2(2011) (Definitions)]*	
52	Are spare stub-up provided at pad-mounted transformers?	
53	Electrical equipment room with dry transformers ventilated for maximum temperature of 32 °C (90 °F)?	
Insulated Power Circuits		
54	Is each isolated power circuit controlled by a switch or circuit breaker that has a disconnecting pole in each isolated circuit conductor to simultaneously disconnect all power?	
Note	*Such isolation shall be accomplished by means of one or more isolation transformers, by means of generator sets, or by means of electrically isolated batteries. Conductors of isolated power circuits shall not be installed in cables, raceways, or other enclosures containing conductors of another system. [Refer to NEC-2011, 517.160(A)(1)]*	
Emergency Electrical Systems		
55	Are maintenance-free gel cell-type batteries used in all emergency lights, except fluorescent lights (where NiCad is acceptable)?	

Number	Item	Y/N/NA
Note	*NEC Definitions 700.2, Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction. These systems are intended to automatically supply illumination, power, or both, to designated areas and equipment in the event of failure of the normal supply or in the event of accident to elements of a system intended to supply, distribute, and control power and illumination essential for safety to human life.*	
56	Is there a means for testing all emergency lighting and power systems during maximum anticipated load conditions?	
Note	*Refer to 700.16 for emergency illumination. Refer to NEC 700.17 for branch circuits for emergency lightning*	
Note	*For testing and maintenance procedures of emergency power supply systems see NFPA 110-2010, Standard for Emergency and Standby Power Systems.*	
57	Is the emergency system equipment suitable for the maximum available fault current at its terminals? (Refer to NEC-2011 700.4)	
58	Is a sign posted at the service-entrance equipment, indicating type and location of on-site emergency power sources? (Refer to NEC-2011 700.7)	
Note	*Where removal of a grounding or bonding connection in normal power source equipment interrupts the grounding electrode conductor connection to the alternate power source(s) grounded conductor, a warning sign shall be installed at the normal power source equipment stating: WARNING SHOCK HAZARD EXISTS IF GROUNDING ELECTRODE CONDUCTOR OR BONDING JUMPER CONNECTION IN THIS EQUIPMENT IS REMOVED WHILE ALTERNATE SOURCE(S) IS ENERGIZED. NEC 700.7(2011)*	
59	Are emergency system maintenance procedures available according to NEC-2011 700.3?	
60	Do storage batteries used as a source of power for emergency systems of suitable rating and capacity to supply and maintain the total load for a minimum period of 1½ hours, without the voltage applied to the load falling below 87½ percent of normal?	
61	Is a portable or temporary alternate source available for whenever the emergency generator is out of service for major maintenance or repair?	
62	Are all boxes and enclosures (including transfer switches, generators, and power panels) for emergency circuits permanently marked so they will be readily identified as a component of an emergency circuit or system? (Refer to NEC-2001 700.10)	
63	Is wiring from an emergency source or emergency source distribution over current protection to emergency loads kept entirely independent of all other wiring and equipment, unless otherwise permitted in NEC-2011 700.10(B) (1) through (5)?	
64	Is transfer equipment designed and installed according to NEC 700.5 to prevent the inadvertent interconnection of normal and emergency sources of supply in any operation of the transfer equipment? Transfer equipment and electric power production systems installed to permit operation in parallel with the normal source shall meet the requirements of Article 705.	
65	Are emergency system signals provided in accordance with NEC-2011 700.6 for derangement, carrying load, not functioning, and ground fault?	
66	Do emergency systems sources of power comply with NEC-2011 700.12?	
67	Do uninterruptible power supplies used to provide power for emergency systems comply with the applicable provisions of NEC 700.12(A) and (B)?	

Number	Item	Y/N/NA
68	Do emergency system circuits, for lighting and power comply with NEC-2011 700.15-700.18?	
69	Do emergency system lighting circuits comply with switch requirements in NEC-2011 700.20 and 700.21 for switch location?	
70	Is the branch-circuit over current devices in emergency circuits accessible to authorized persons only? (Refer to NEC-2011 700.25)	
71	Does ground fault emergency system equipment protection comply with NEC-2011 700.26?	
72	Are emergency system(s) over current devices selectively coordinated with all supply side over current protective devices? (Refer to NEC-2011 700.27)	
73	Are any legally required standby systems identified according to NEC-2011 701.2?	
Working Space about Electrical Equipment		
74	Is adequate workspace designed around equipment?	
Note	*The depth of the working space in the direction of access to live parts may not be less than indicated in 29 CFR 1910.303(g)(1), Table S-1. Distances shall be measured from the live parts if they are exposed or from the enclosure front or opening if they are enclosed.*	
75	Is there a minimum working space of 30 in (762 cm) width in front of electrical equipment operating at 600 volts or less? (29 CFR 1910.303(g)(1)	
76	Is a minimum headroom clearance of 6-1/2 ft (2 m) maintained from the floor or platform up to the luminaire or any overhead obstruction?	
Note	*Refer to NEC 110.26 for working space about electrical equipment.*	
77	Is there at least one entrance of sufficient area provided to give access to the working space about electric equipment?	
Note	*Refer to OSHA 1910.303(g)* for working space safety requirements	
Note	*29 CFR 1926.403(i)(1) covers working space. Table K 1 of this standard shows minimum dimension of the working space in the direction of access to live parts operating at 600 volts or less and likely to require examination, adjustment, servicing, or maintenance.*	
78	Are all live parts guarded against accidental contact?	
Note	*Depth of Working Space, NEC 110.26 (2011): The depth of the working space in the direction of live parts shall not be less than that specified in Table 110.26(A)(1) unless the requirements of NEC 110.26(A)(1)(a), (A)(1)(b), or (A)(1)(c) are met. Distances shall be measured from the exposed live parts or from the enclosure or opening if the live parts are enclosed. The width of the working space in front of the electrical equipment shall be the width of the equipment or 762 mm (30 in.), whichever is greater. In all cases, the work space shall permit at least a 90 degree opening of equipment doors or hinged panels. The work space shall be clear and extend from the grade, floor, or platform to a height of 2.0 m (6⅟2 ft) or the height of the equipment, whichever is greater. Refer to NEC 110.26.*	
79	Are all indoor electrical installations that are accessible to unqualified persons made with metal-enclosed equipment?	
Caution and Warning Signs		
80	Are metal-enclosed switchgear, unit substations, transformers, pull boxes, connection boxes, and other similar associated equipment marked with appropriate caution signs?	

Number	Item	Y/N/NA
Arc Fault Hazard Analyses		
81	Has a computerized short circuit analysis and coordination study been performed for large or complex systems?	
82	Is the surge protective device marked with a short circuit current rating and not installed at a point on the system where the available fault current is in excess of that rating? (Refer to NEC-2011 285.6)	
83	An industrial control panel shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with NEC 409.110(4). (Refer to NEC-2011 409.22)	
Equipment Marking		
84	Are industrial control panels supplied by more than one power source such that more than one disconnecting means is required to disconnect all power within the control panel marked to indicate that more than one disconnecting means is required to de-energize the equipment? (Refer to NEC-2011 409.110)	
85	Are industrial control panel (s) marked with the following information that is plainly visible after installation: (1) Manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified (2) supply voltage, number of phases, frequency, and full load current for each incoming supply circuit; and(3) short-circuit current rating. (Refer to NEC-2011 409.110)	
86	Is electrical equipment in facilities such as switchboards, panel boards, industrial control panels, meter socket enclosures, and motor control centers that are in other than dwelling units, and are likely to require examination, adjustment, servicing, or maintenance while energized field, marked to warn qualified persons of potential electric arc flash hazards? (Refer to NEC-2011 110.16)	
87	Are enclosures (other than surrounding fences or walls) of switchboards, panel boards, industrial control panels, motor control centers, meter sockets, enclosed switches, transfer switches, power outlets, circuit breakers, adjustable-speed drive systems, pullout switches, portable power distribution equipment, termination boxes, general-purpose transformers, fire pump controllers, fire pump motors, and motor controllers, rated not over 600 volts nominal and intended for such locations, marked with an enclosure-type number as shown NEC-2011 Table 110.28.	
Overcurrent Protective Devices (OCPDs): Fuses and Circuit Breakers		
88	Breaker and fuse interrupter ratings are adequate according to findings of the short circuit analysis?	
89	Are short circuit and ground fault protective devices for motors, motor circuits and controllers in accordance with NEC-2011 Article 430?	
90	Overcurrent Protective Devices (OCPDs) shall be tested in accordance with the settings based on engineering coordination.	
91	Do motor control centers have draw out breakers, where applicable? (Fused disconnects should be avoided, since breakers provide greater R&M.)	
92	Is alternate feed to facility required to provide increased reliability? (Hospitals and mission-essential facilities may benefit from dual feeders.)	

Number	Item	Y/N/NA
93	Are circuit breakers used instead of fuses? (Use of circuit breakers increases Reliability and Maintainability (R&M), as spare fuses do not need to be kept in storage and circuit restoration is not dependent on the availability of a fuse.)	
Note	*NEC Article 240 of the (NEC) provides the basic requirements for over current (i.e., overload, short-circuit, and/or ground fault) protection.*	
Note	*NEC 430.31 (2011), General, Part III specifies overload devices intended to protect motors, motor-control apparatus, and motor branch circuit conductors against excessive heating due to motor overloads and failure to start.*	
Note	*NEC-2011 490.46, Circuit Breaker Locking: Circuit breakers shall be capable of being locked in the open position or, if they are installed in a draw out mechanism, that mechanism shall be capable of being locked in such a position that the mechanism cannot be moved into the connected position. In either case, the provision for locking shall remain in place with or without the lock.*	
Note	*NEC-2011 110.24(A) requires service equipment in other than dwelling units to be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault current calculation was performed and be of sufficient durability to withstand the environment involved. NEC 110.24(B): When modifications to the electrical installation occur that affect the maximum available fault current at the service, the maximum available fault current shall be verified or recalculated as necessary to ensure the service equipment ratings are sufficient for the maximum available fault current at the line terminals of the equipment. The required field marking(s) in 110.24(A) shall be adjusted to reflect the new level of maximum available fault current. Exception: The field marking requirements in 110.24(A) and 110.24(B) shall not be required in industrial installations where conditions of maintenance and supervision ensure that only qualified persons service the equipment.*	
Cables versus Bus Ducts		
94	Is bus duct use considered, rather than cabling, for circuits of 600 amperes or greater? (It is difficult for electricians to work with such a circuit, as it requires a conductor greater than 500 Thousand Circular Mils (MCM) (thousand circular mils) [or 500 MCM in parallel].)	
Electric Motors		
95	Motor size and application warrant use of under voltage motor protection? (History of motor failures at the base should be a factor.)	
Note	*The result of a motor under voltage condition is an increase in current, motor heating and a reduction in motor performance. The under voltage motor protection is a backup for the thermal overload. In some cases, it is desirable to trip the motor faster than thermal overload element. Reference: http://www.l-3.com/private/ieee/Motor%20Protection%20Principles.pdf*	
Note	*Motor control center has adequate workspace to ensure maintainability?*	
96	Correct overloads specified for motors? (Overloads should be no larger than specified by the NEC-2011 430.31-430.32	
Switchgear		
97	Switchgear has:	
98	Draw out breakers?	

Number	Item	Y/N/NA
99	Lifting brackets for breaker maintenance?	
100	Easy accessibility for maintenance?	
101	Cable trenches?	
102	Emergency lighting?	
	Overhead Lines and Cables	
103	Appropriate places on overhead lines specified to have stirrups? (Use of stirrups prevents damage to conductor when a connection is made.)	
104	A provision is made for the avoidance of contact with power lines.	
Note	*Reference: Distribution System Design Manual for Fort Richardson, Fort Greely, and Fort Wainwright Electric Distribution Systems says "New distribution lines will be designed to meet NESC Grade "B" construction to the greatest extent possible." retrieved from: http://doyonutilities.com/wp-content/uploads/DU-Electrical-Distribution-System-Design-Manual.pdf*	
	Underground Distribution Lines	
105	Underground primary cables are cross-linked polyethylene (XLPE) or ethylene propylene rubber (EPR), with 133% insulation level with outer jacket? (Outer jacket is only necessary to protect concentric neutral from corrosion.)	
Note	*Refer to NEC 310.104 for conductor specifications; Insulated conductors shall comply with the applicable provisions of Table 310.104(A) through Table 310.104(E)-2011.*	
106	Is direct-buried cable or conduit or other raceways installed to meet the minimum cover requirements of NEC-2011 Table 300.5? Refer to NEC 300.5C for exception.	
Note	*The interior of enclosures or raceways installed underground shall be considered to be a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall be listed for use in wet locations and shall comply with 310.10(C). [Refer to NEC 300.5(B)]*	
107	Underground switches are oil-less, with dead fronts? (Vacuum or SF6 switches are preferred.)	
108	Fault indicators on underground switches? (Fault indicators are essential for quickly locating faults on underground circuits. Fault locators should automatically reset.)	
109	Concrete cable markers required at each change of direction and at approximately 69.9-meter (200-foot) intervals to indicate location of underground cables?	
110	Cable warning tapes required above all underground cables? (See AFJMAN 32-1080, *Electrical Power Supply and Distribution*).	
111	Underground cable ampacity designed for future growth? (Cable size should take into account any derating requirements, such as multi-cable ducts.)	
	Manholes – Confined and Enclosed Spaces	
112	Sufficient working space for two people?	
Note	*Refer to OSHA 29 CFR 1910.269 proposed/final rule requirements for enclosed spaces and other requirements.*	
113	Have all enclosed spaces been identified and classified as a permit required confined space, as appropriate?	
114	Are there provisions for the atmosphere in enclosed spaces evaluated for oxygen, hydrogen sulfide and combustible gases?	

Number	Item	Y/N/NA
115	Procedures for all hazards in enclosed spaces identified and evaluated?	
116	Is ventilation available or designed to provide positive pressure ventilation for entering enclosed spaces?	
117	Has a job briefing been completed and documented for all persons entering enclosed work spaces?	
118	Sump holes (sealed sump holes in high-water areas) and pulling irons opposite all duct entrances, plus one on center of floor? (Consider reinforcing duct entrances to reduce shearing. Specify sealed duct ends to prevent rodent intrusion.)	
119	Duct line markers used to locate duct routes and turns?	
	Underground Cable Splices	
120	Prohibited, or allowed only where necessary?	
121	Employ maintenance-free methods and materials (e.g., heat shrink, resin casting)?	
Note	*Refer to NEC 300.5 for underground installation requirements for minimum cover, wet locations, cables under buildings, protection from damage, splices and taps, backfill, raceway seals, bushing, conductors of the same circuit, earth movement and directional boring.*	
	Substations	
122	Adequate bypass capability so breakers can be serviced?	
123	Substation locations:	
124	Located away from base perimeter fences and heavy-traffic roads?	
125	Access roads able to accommodate line maintenance vehicles?	
126	Two sets of multi-ratio current transformers (one set each for instruments and relays)?	
127	Low-maintenance breakers (e.g., vacuum, SF6, air)?	
128	Any special maintenance tools included as part of facility?	
129	Two power transformers, each capable of carrying the load, considered for reliability and ease of maintenance?	
130	Permanent schematics specified to be installed?	
Note	*Refer to NEC 225.70 for substation requirements for warning signs.*	
	AIRFIELD LIGHTING	
	Airfield Lighting Vault	
131	Designed with 480-volt overhead bus duct distribution system?	
132	Designed with devices and equipment to facilitate removal and replacement of regulators, such as an overhead crane?	
133	Heat loading considered? (Vault may require air conditioning.)	
134	Adequate work space, storage area, and a latrine?	
135	Isolation transformers installed in cans, not directly buried? (Consider installing transformers 15.2 meters (50 feet) from the edge of the runway to allow maintenance during runway use.)	
136	All elevated visual navigational aids incorporate frangible, low impact resistant or semi-frangible design principles in accordance with AFMAN 32-1076, *Design Standards For Visual Air Navigation Facilities*?	
137	All foundations designed to be flush with grade?	

Number	Item	Y/N/NA
138	All hand holes and manholes within apron, taxiway, tow way, runway, and overrun shoulder areas designed for a 34,000-kilogram (75-kip) wheel load?	
Note	*FAA publishes airfield lighting design guidelines. For example the design, installation and maintenance of in-pavement lighting is available at: http://www.faa.gov/airports/engineering/airport_lighting/media/schai_airport_lighting.pdf. FAA Series 150 Advisory circulars for airfield lighting: http://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.list/parentTopicID/63, 150/5340-30G, Design and Installation Details for Airport Visual Aids*	
Note	*"The Air Force generally follows FAA standards which are primarily published as advisory circulars, handbooks, and specifications. However, when they are in conflict with the Air Force AFMAN 32-1076 a requirement, this manual takes precedence." Source: http://webapp1.dlib.indiana.edu/cgi-bin/virtcdlib/index.cgi/821003/FID2/pubs/af/32/afman32-1076/afman32-1076.pdf*	
139	LIST ANY ADDITIONAL LOCALLY-UNIQUE R&M DESIGN FEATURES TO BE CONSIDERED	